California's Water-Energy Relationship

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A Symposium:

Improving the Efficiency of California's Water and Energy Systems

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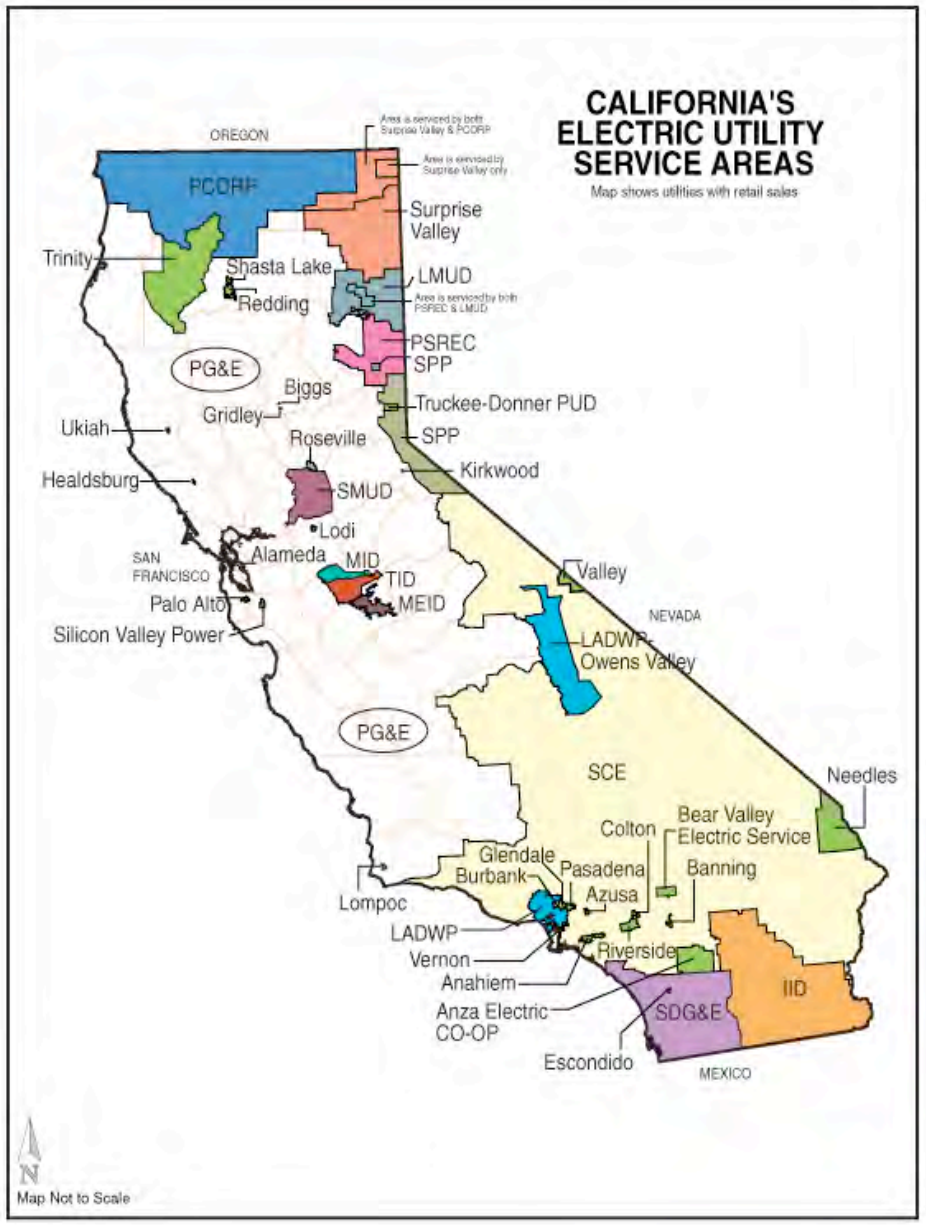
2005 Energy Policy Report

- **Integrated Assessment of Major Energy Trends and Issues**
  - Ensure adequate, reliable supplies
  - Improve efficiency and reduce demand
  - Improve infrastructure
- **Water-Energy Relationship**
  - Understand the links
  - Demand and supply strategies
  - Changes in the hydrologic cycle
  - Energy system implications

http://energy.ca.gov/2005publications/CEC-700-2005-011/CEC-700-2005-011-SF.PDF

Energy

- **Population:** ***34 million, 1.2% per year growth***
- **Multiple Utility Service Territories**
- **2004 Electricity Use:** ***271,000 GWh***
- **2004 Peak Demand:** ***56,435 MW***
- **2016 Demand:**
  Use – 323, 372 GWh ?
  Peak – 69,473 MW ?



Water

- **Water Demand:**
  43 maf
- ***2/3*** **of Precipitation in North**
- ***2/3*** **Demand in the South**
- **Energy Use:**
  250,500 GWh; 13,600 MTh
- **Supplies Power to the Grid**
- **Population by 2030:**
  48 million
- **2030 Water Demand:**
  43-50 maf ?

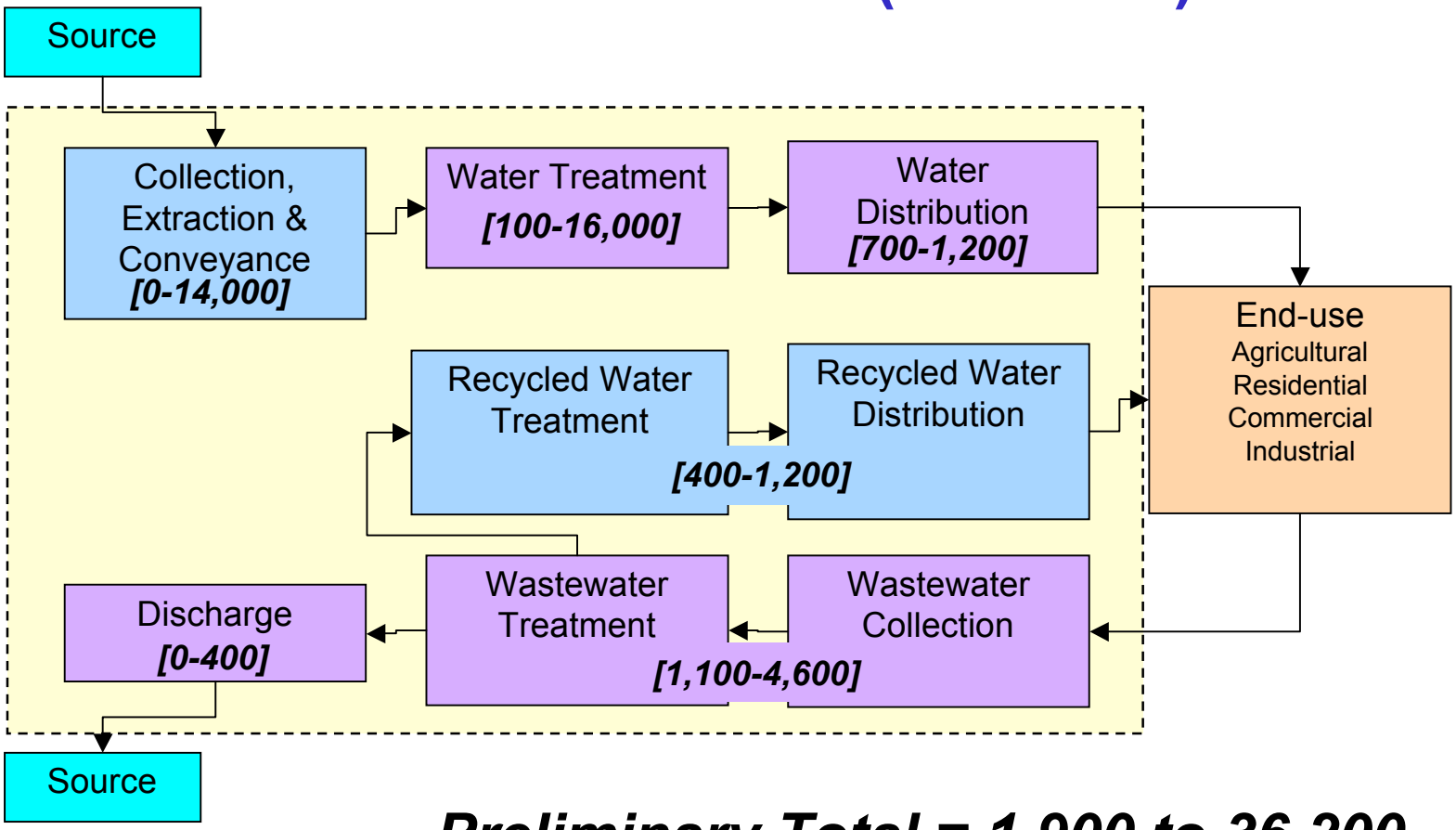
Common System Issues

- Growing Demand
- Resource Adequacy
- Resource Quality
- Infrastructure
- Cost
- Environmental Protection
- Long-term Uncertainty

Water-Related Energy Use

	Electricity (GWh)	Natural Gas (Mil l. Therms)	Diesel (Mill . Gallons)
Water Supply and Treatment			
Urban	7,554	19	?
Agricultural	3,188		
End Uses			
Agricultural	7,372	18	88
Residential	27,887	4,220	?
Commercial			
Industrial			
Wastewater Treatment	2,012	27	?
TOTAL	48,012	4,284	88
2001 Consumption	250,494	13,571	?
Percent of Statewide Energy Use	19%	32%	?

Water Use Cycle Energy Intensities (kWh/MG)



Preliminary Total = 1,900 to 36,200 kWh/MG

Regional Differences

	Northern California kWh/MG	Southern California kWh/MG
Conveyance	150	8,900
Treatment	100	100
Distribution	1,200	1,200
Wastewater Treatment	2,500	2,500
Regional Total	3,950	12,700

Energy Efficiency Programs

	2006-2008	Water Use Efficiency
GWh (annualized)	6,812	6,500
MW	1,417	850
Funding (million $)	1,500	826
$/Annual kWh	0.22	0.13
WUE Relative Cost	58%	

Water in the Energy Sector

- **Hydroelectric Generation**
  - Dams and run-of-the-river
  - Pumped storage facilities
  - In-conduit
- **Other Renewable Resources**
  - Biogas
  - Solar
- **Power Plant Water Use**
  - Closed-looped cooling
  - Once-through cooling

Producing Energy from Water

- **Constraints**
  - Energy market/system complexity
  - Cost and complexity of interconnection
  - Stand-by charges
  - Net metering limitations
- **Promote self-generation:**
  - Off-set power requirements from grid
  - Support interconnection
  - Identify incentives

Water - Energy Synergies

- ✓ **End-User Water and Energy Efficiency**
  - ✓ Saving water can save energy
  - ✓ Saving energy can save water
- ✓ **Infrastructure Improvements**
  - ✓ Improve operational efficiency of systems
  - ✓ Retrofit infrastructure with efficient designs and technologies
- ✓ **Improve Price Signals**
  - ✓ Advanced metering
  - ✓ Time-Of-Use rates

Water - Energy Synergies
(cont.)

- ✓Water Storage
  - ✓Increased storage allows for shifting
  - ✓Pumped storage increases available generation
- ✓Renewable and Self Generation
  - ✓Increased development of in-conduit and biogas
  - ✓Development of wind and solar

2005 EPR Recommendations

- Invest in saving water to save energy
- Reduce water sector energy intensity
- Improve system flexibility
- Provide better price signals
- Promote self-generation
- Reduce cooling-related environmental impacts
- Invest in research and development
- Work together

Take Actions Now

- Coordinate Utilities' Programs
  - 2006-2008 Utility Efficiency Programs
  - Renewable Portfolio Standard
  - Upgrading Infrastructure
- Address regulatory challenges
  - Self generation impediments
  - System Constraints
- Develop better data and information

Information

www.energy.ca.gov

2005 IEPR, Chapter 8 Integrating Water and Energy Strategies

http://www.energy.ca.gov/2005publications/CEC-100-2005-007/CEC-100-2005-007-CMF.PDF

California's Water-Energy Relationship-Final Staff Report

http://www.energy.ca.gov/2005publications/CEC-700-2005-011/CEC-700-2005-011-SF.PDF